BERMUDA OCEANOGRAPHIC EXPEDITIONS

1929—1930

INTRODUCTION*

By WILLIAM BEEBE

(Figs. 1-7 incl.)

I. FOREWORD

The idea of carrying on daily deep-sea trawling with a shore laboratory for a base occurred to me on July 15th, 1925, when I was establishing Station No. 100 on the *Arcturus,* a few miles south of Bermuda. I had not the slightest idea that four years later I should be located on the island of Nonsuch, then visible from the bridge, and with the same winch then in use, I would be trawling over this identical area.

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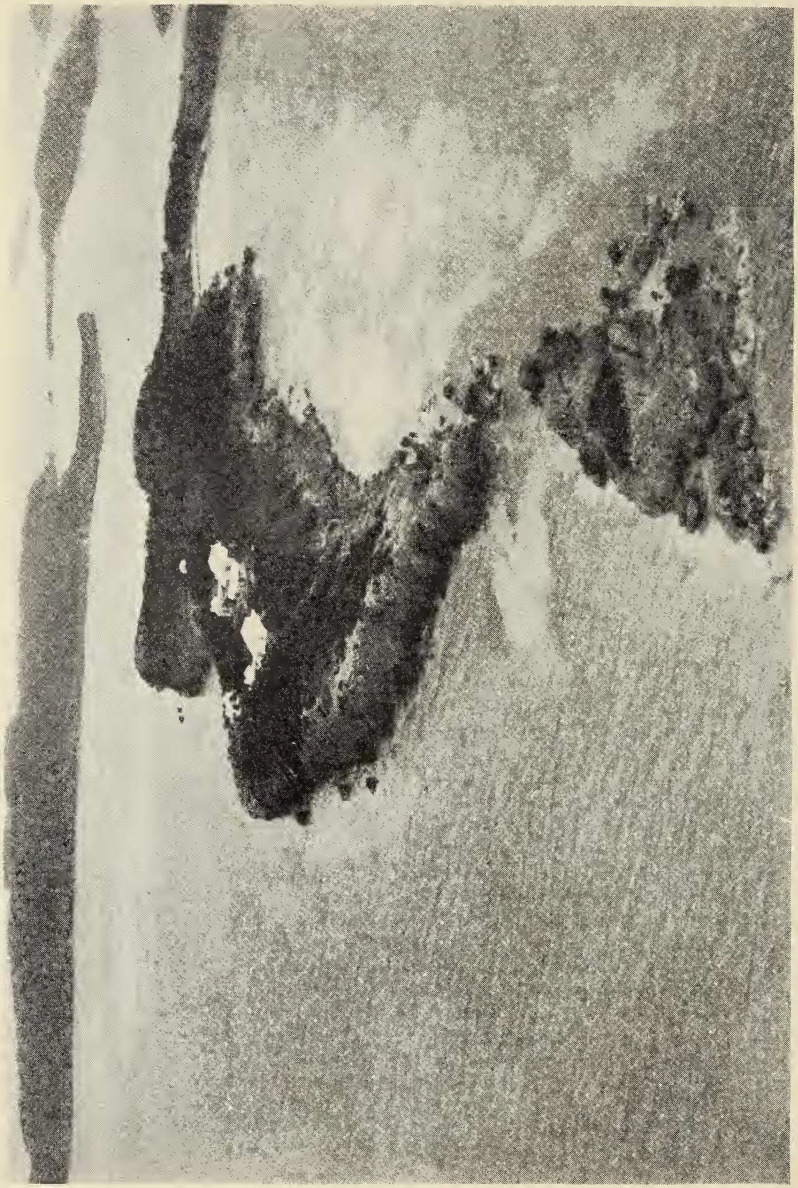

Fig. 1. Airplane view of Nonsuch Island, showing laboratories and neighboring reefs. Photo by Capt. Nelmes.

The vibrations and other drawbacks to microscopic and similar laboratory work and the very great cost of an expedition like that of the *Arcturus* induced me to begin experiments. I found by several trips to the Hudson Gorge off New York City, that on an ordinary tug boat I could easily haul six one-metre nets at an extreme depth of 1400 fathoms, and that the resulting catches were as varied and rich, and came up in as good condition as those on the *Arcturus*[1]. Two short visits to Bermuda made me certain that this would form an excellent headquarters. Good fortune attended me, for on a picnic to Nonsuch with His Excellency, the late Governor Sir Louis Bols and the Honorable F. Goodwin Gosling, I was offered the use of the island with its excellent buildings if I cared to use it. Examination of the map showed that this was the most desirable place in Bermuda for my work. It was well isolated from the hotels and troublesome tourists, yet within easy reach of St. Georges; Castle Roads was a convenient passage for a vessel to the open sea, and a depth of 1000 fathoms was to be found only five miles off shore to the south.

I found that at St. Georges a sea-going tug, the *Gladisfen,* was available for charter at a reasonable price, and most important of all, when I had assembled all my plans and formulated them, two very great friends, Harrison Williams and Mortimer Schiff, offered to finance the expedition.

This was the evolution of the Bermuda Oceanographic Expedition of the New York Zoological Society.

II. Oceanographic Investigation near Bermuda

The waters of Bermuda have been visited by the vessels of some of the most important oceanographic expeditions. When I am ready to publish the total catch of deep-sea fish taken in the restricted area, I will summarize the hauls and other results of the other expeditions. Here I need only briefly to list the stations:

The *Challenger* in 1873 made twenty-seven Stations and Substations within one hundred miles of my trawling center.
The *Margrethe* in 1913 made three Stations.
The *Dana* in 1920 and 1922 made three Stations.
The *Arcturus* in 1925 made seven Stations.
The *Pawnee* in 1927 made two Stations.
The *Chance* in 1927 made two Stations.
The *Albatross* in 1929 made four Stations.

[1] Zoologica Vol. XII, Nos. 1; Zool. Soc. Bull. Vol. XXII, No. 2.

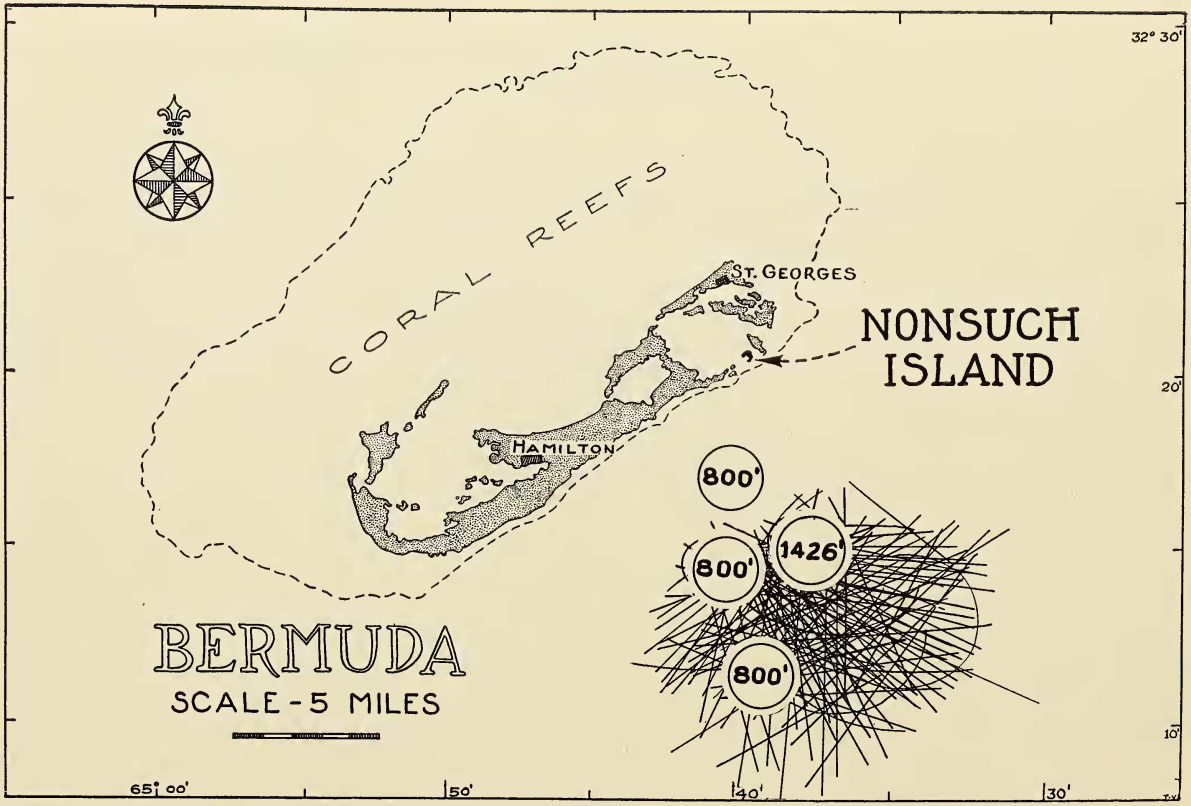

Fig. 2. Diagrammatic view showing Nonsuch Island, the area of trawling, and the location of four deep dives of the Bathysphere.

Tarleton Bean in 1906 in a list of fishes of Bermuda enumerates several deep-sea fish, apparently washed ashore.

III. Collecting Apparatus on the *Gladisfen*

The *Gladisfen* is a sturdy tug ninety-three feet over all. It was found possible to fit her with satisfactory trawling, dredging and sounding apparatus without altering any of her structure. On the forward deck, amidships, just forward of the pilot house was installed the sounding machine, the wire leading to a pivoting yard arm which swung overboard at right angles to the tug when in action.

Immediately aft of the towing bitts was placed the smaller winch or towing engine with its load of 15,000 feet of quarter inch wire. This cable led directly astern over a sheave mounted on steel davits, projecting so far overboard that the descending wire hung clear of the rudder. This gave room for a suspended metre-wheel, for a two-man, block-and-tackle reeling arrangement, and a man to stand and oil the in-coming cable. Instead of freeing the wire of superfluous water by banging it with clubs as we did on the *Arcturus,* two men who attended to the attachment and unfastening of the weight and nets, let the wire run through a mass of sacking with which they gripped the cable.

Both the sounding machine and the towing engine are described by Mr. Tee-Van in the account of the operation and equipment of the *Arcturus.* (Zoologica Vol. VIII, No. 2.)

IV. Trawling Accidents

While it is the custom to record only the successes of an expedition, it has seemed only fair to tell very briefly of the accidents. During the two seasons of work and the hauling of 976 nets we lost nineteen nets by accident, as follows:

3—Lost overboard and in propellor.
3—Ripped from too long use.
7—Torn away when bottom was touched.
1—Torn away from excess speed.
5—Lost from breaking of sister hooks.

Besides this we touched bottom accidently four times without doing any harm to the nets; six nets became entangled or wound about the cable or brass attaching balls, resulting in no catch, and finally two brass balls were lost from the breaking of their hinges without the loss of the nets.

On July 16, 1929, the side of the drum of the towing engine gave way. About a third of the circumference went, the central

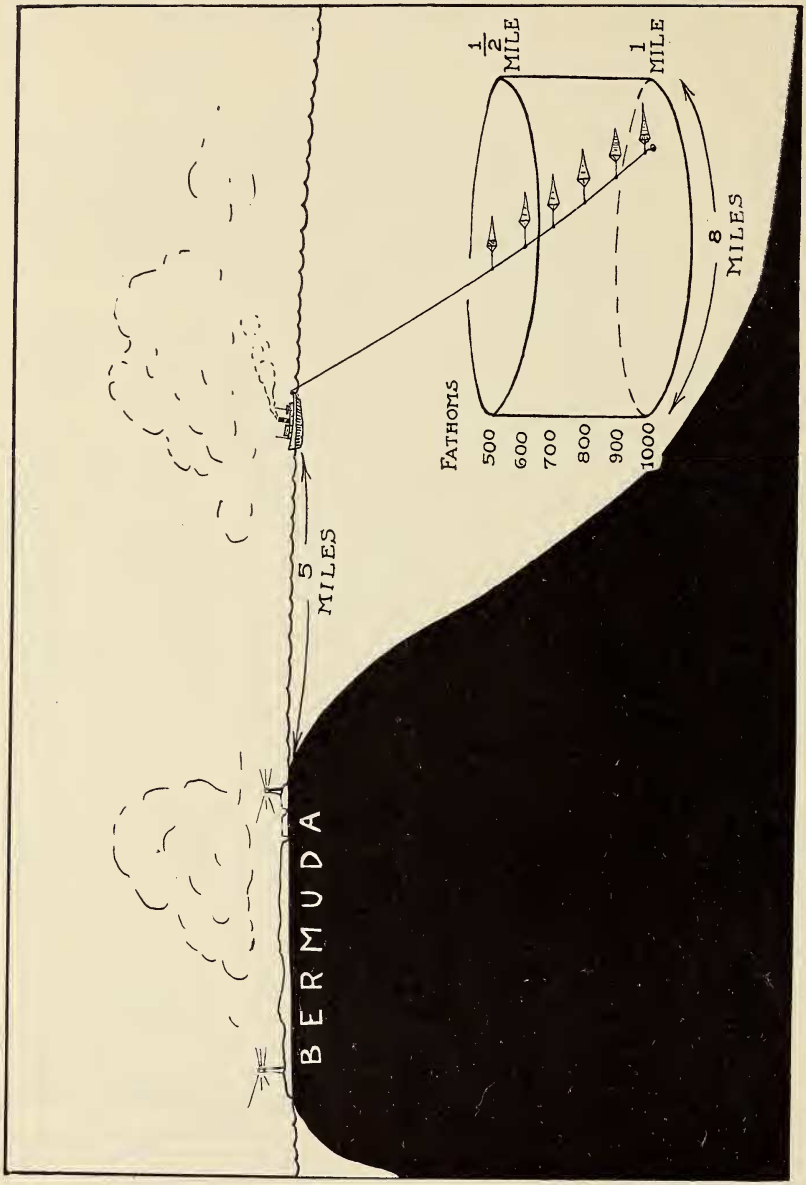

Fig. 3. Diagrammatic section showing the tug and general position of the cylindrical trawling area.

portion down to the core. There was no sign of a break before it actually shattered, and no sound when it collapsed, the piece of metal merely dropping off. Fortunately the collapsed rows of cable did not prevent the operation of the winch, so the wire and nets were saved. The break was repaired in the Government Navy Yard.

Exactly one year later, on July 16, 1930, the reinforced side of the drum again broke, this time so badly that a new drum had to be ordered and installed.

V. Method of Work

Our routine of deep sea work varies little from day to day. The *Gladisfen* with her native Bermudian crew of five, steams out from St. Georges, skirts the west shore of Castle Harbor and ties up at her buoy near our wharf about 7 A. M. Usually before her warning whistle blows the two or three members of my staff due for sea duty that day are on their way with racks of mason jars, lunch, extra nets, pails, shark hooks and bait. They go out in our fast launch the *Skink* and immediately the tug steams out through Castle Roads to the open sea. The succeeding course depends on the wind and currents, but it is usually south or south-west.

When at the rim of my imaginary cylinder, as indicated by the relative position of Gibbs Hill and St. David's Lighthouses, the tug is slowed down and the weight is put overboard. One after another, six one-meter nets are attached at equal distances apart, and then sufficient cable paid out to lower the first net to 1000 fathoms, bringing the upper to 500 fathoms.

Then begins a four or five hour vigil, watch being kept on engine revolutions, winch, wire, angle of the wire both lateral and vertical, as well as for any sign of change in the weather affecting wind, current or wave. The surface is scanned for sharks, dolphins, squids, or other creatures, the air watched for birds, and passing sargassum weed is netted and examined for fish and rare invertebrates.

Occasionally in a flat calm, when weed is abundant, a boat with outboard motor is launched and I have had great sport catching young flying-fish on the wing with a butterfly net.

After as long as possible a haul, the trawling crew is assembled, steam is gotten up, and slowly the cable is reeled in. Two men take their place at the very stern watching the wire and wiping off excess water, another oils the cable as it goes on the reel, two more handle a horizontal block and tackle, guiding the cable back and forth so that it is spooled evenly.

Fig. 4. Tug *Gladisfen* used in all trawling work of the Bermuda Oceanographic Expedition.

Fig. 5. Metre net, sheave, wire and winch on the aft deck of the *Gladisfen*.

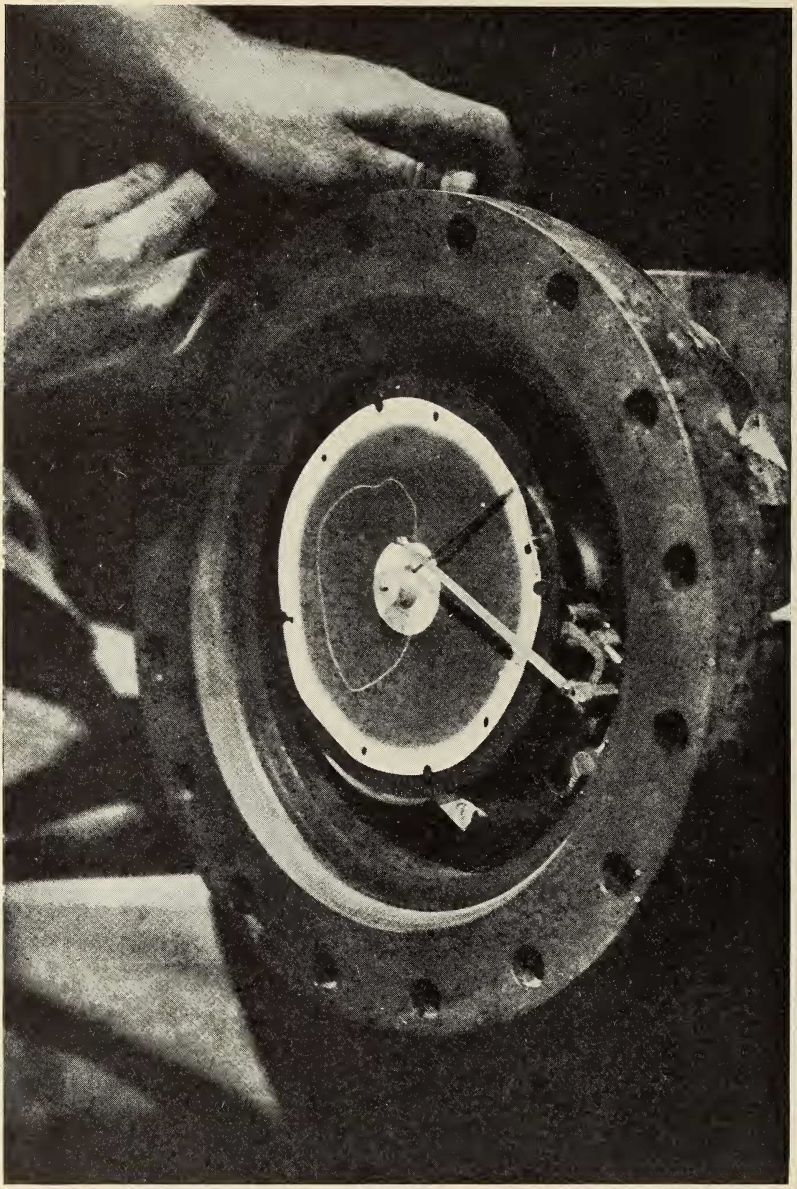

Fig. 6. Clock-work mechanism and recording sheet of the Bathygraph, used for indicating the entire course of a net in trawling.

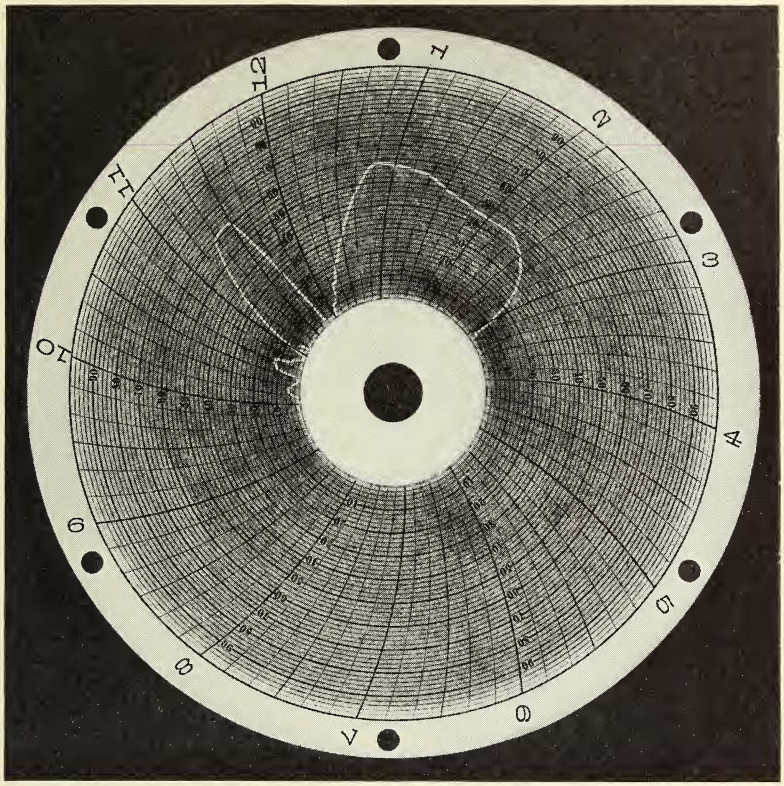

Fig. 7. Record of the Bathygraph showing successively deeper temperature and water sample records, and the course of a thousand fathom trawl continued for two hours.

When the first net appears it is carefully detached, carried into the aft cabin and the mason jar cut free, labelled and placed in its rack. The lower part of the net is then washed for whatever organisms may be caught in it. The entire net is washed and passed to the upper deck to dry. A rough assorting takes place. All large living fish are placed by themselves in a pail with ice. Very delicate forms are placed in formaline. After the last net is aboard the tug is headed full speed for Nonsuch.

At the wharf the jars are carried gently by hand to the laboratory and emptied into individual pans. A finer, thorough assorting now takes place. I pass all new forms showing bright colors to the artist who makes quick color notes; others are taken by the photographer. The great majority are sorted out,

catalogued by those in charge of the vertebrates and the invertebrates, and notes of evanescent color, form and movement made before preservation. The rare living fish and squids are put into the refrigerators, for further study in the morning.

VI. Brief Narrative of the Expedition

An account of the expedition will be given in a future number of Zoologica in full detail. Here it is only necessary to present the more salient facts.

The Expeditions of 1929 and 1930 are known as the 12th and 13th Expeditions of the Department of Tropical Research of the New York Zoological Society, under the Directorship of Dr. William Beebe. The First was in the field from March 13th to October 22nd, 1929, and the Second from April 11th to October 30th, 1930.

The personnel for the two years was as follows:

Director—William Beebe
General Assistant—John Tee-Van
Technical Associate—Gloria Hollister

Scientific Associates

William K. Gregory
Charles J. Fish
Marie P. Fish
E. Newton Harvey
Otis Barton
William Merriam

Laboratory Assistants

P. Boyden
Jocelyn Crane
Margaret Elliott
Alice Wright
Virginia Ziegler

Artists

E. M. Bostelmann
G. Bostelmann
Helen Tee-Van
Llewellyn Miller

Photographers

J. Connery
R. Whitelaw

Field Assistants

Arthur Tucker, Government Care-taker of Nonsuch.
H. Barnes
P. Bass
J. Cannon
P. Crouch
J. Guernsey
A. Hollis
P. Jackson
S. von Hallberg

The chief object of the expedition may be said to be the study of the fish of Bermuda in the widest sense,— those of the tide-pools and shallow waters, of the surface of the ocean, of the mid-waters, and of the abyssmal depths.

In actual practice this divided itself into two divisions—the fish fauna of the shallow waters and those of the ocean deeps. The first we caught and studied by means of hooks and lines, nets, seines, traps, poisons, dynamite, water glasses, glass-bottomed boats, diving helmets and, in the case of adult flying fish, even shot-guns. The fish of the second division were taken with nets, trawls and dredges, and were observed through the quartz windows of the bathysphere down to a depth of a quarter of a mile.

The two most important accessory aids used for the first time on the expeditions were a depth recording gauge of great accuracy which gave complete records of nets down to one thousand fathoms, and the all-steel bathysphere in which Mr. Barton and I were able to descend easily, observe clearly and ascend safely from depths down to 1426 feet. A detailed account of this will be found in the Zoological Society's Bulletin, Volume XXXIII, Number 6, and will be dealt with again in future Zoologicas.

The total cost of each expedition was $33,000 and of this $66,000 Mr. Harrison Williams and Mr. Mortimer Schiff contributed all but $10,000. This latter sum was divided between Burt Massee, F. C. Walcott, Ernest F. Weir, Edna Albert, W. E. Boeing, Herbert L. Satterlee and William Delano.

VII. Locality Chosen for Study

The following 976 nets were hauled through a definite area of open ocean, south of Bermuda. This area is roughly circular, eight miles in diameter, and the great majority of the nets were drawn at 500, 600, 700, 800, 900, and 1000 fathoms.

Observations by means of the two light-houses, Gibbs Hill and St. Davids, made it possible to get accurate sights at the beginning and the end of each individual haul. Soundings give a clear idea of the contour of the bottom of this oceanic cylinder. These, together with physical results of temperature, salinity, oxygen content, etc., will be tabulated at the end of the third year of study.

To give the location with more exactness;—the eight mile circle under consideration has its center at 32° 12′ North Latitude, and 64° 36′ West Longitude, which point is 160 degrees by

the compass, or South-south-east of Nonsuch. Its horizontal boundaries are as follows;—

Northern rim—32° 16′ North Latitude.
Southern rim—32° 8′ North Latitude.
Eastern rim—64° 31′ 20″ West Longitude.
Western rim—64° 40′ 40″ West Longitude.

At no place is its bottom less than 1000 fathoms in depth. It slopes rather rapidly in the northeastern corner to 1357 fathoms, and along its southern border is between 1400 and 1500 fathoms deep. My first deep dive of 803 feet was in the southwest sector, and the 1426 foot dive was on the northern rim.